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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/360,582	BLACKBURN, BRANDON W.	
	Examiner	Art Unit	
	Johannes P. Mondt	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 March 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4,5,7 and 8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4,5,7 and 8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *3/20/07* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/20/07 has been entered.

Response to Amendment

Amendment filed 3/20/07 with said request for Continued Examination forms the basis for this Office Action. In said Amendment Applicant cancelled claims 2 and 6 (claim 3 was previously cancelled), and substantially amended claims 1, 4, 5, 7 and 8. Applicant also amended the Specification and submitted Replacement Sheets for the Drawings of Figures 1 and 2. Comments on Remarks submitted with said Amendment are included below under "Response to Arguments".

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference signs jointly mentioned with reference to a single Figure in the description: in particular numerals 12 and 30 are not shown in relation to its other in a single Figure and their relationship has been made more confusing by amendment:

Figure 1 schematically shows "neutron source" 12 but not 30. Figure 2 shows "portion 30 of 12" but not 12. But: in use, target 32 is the material that produces neutrons upon being hit by accelerator beam of energetic particles (protons or deuterons) (see original Specification, page 6, line 6). Accordingly, 30 appears to comprise 12 rather than the other way around as suggested by the language. Applicant should provide a Drawing wherein the relation between 12 and 30 is illustrated in one and the same Figure.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance. This objection is a repeat of the objection in section 1 under "Drawings" provided in the previous action on the merits.

Specification

1. The amendment to the specification is objected to for reference to both elements 12 and 30 in the description of Figure 1 while only numeral 12 is shown in said Figure 1.

2. The specification is furthermore objected to for not disclosing the connection nor the topographic relation between the neutron source 12 and a portion thereof described by numeral 30 shown in Figure 2.

Figure 1 schematically shows "neutron source" 12 but not 30. Figure 2 shows "portion 30 of 12" but not 12. But: in use, target 32 is the material that produces neutrons upon being hit by an accelerator beam of energetic particles (protons or deuterons) (see original Specification, page 6, line 6). Accordingly, 30 appears to comprise 12 rather than the other way around as suggested by the language. However, this is evidently not the case according to the Specification, especially the amended portion. As shown in Figure 2, the heart of the neutron source is target 32. Figure 2 also shows the surroundings of said target. Neutrons are produced in said target through collisions between target atoms and energetic particles in the accelerator beam, with velocities distributed over all directions in solid angle 4π. Therefore, although a portion of an outlet can be said to be shown in Figure 2, "outlet" cannot possibly imply any guide or channel for said neutrons: no such guide or channel is shown in any Drawings, or discussed in the original Specification, while any reference to Eggers is in error at least because Eggers has not been incorporated by reference in the original specification.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

1. ***Claims 1, 4-5, 7 and 8*** are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contain subject matter not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention.

In particular, a method of cooling a low Z target material for a neutron assembly or a liquid cooling system for a neutron assembly or a neutron source assembly having a liquid cooled target with cooling system, including a nozzle submerged in liquid gallium as recited in independent claims 1 (line 3), claim 5, line 7) and claim 8 (line 5) has not been disclosed in the original Specification including original claims. According to the Specification, the "liquid gallium fills chamber 40", while the "source includes a nozzle 34". However, not disclosed is whether nozzle (shown over or in chamber 40 (Figure 2) is in said chamber 40, nor whether, even if nozzle 34 is in chamber 40, said chamber is filled enough so as to cause said nozzle to be submerged in said liquid gallium. Reference is also made to "initial tests, using water coolant" in a "submerged jet impingement configuration" (Specification, page 6, lines 18-20 as originally filed). However, "submerged jet" does not necessarily mean "submerged nozzle" (see, e.g., Pais et al, IEEE, 1994 Intersociety Conference on Thermal Phenomena, "Single-Phase Heat Trnasfer Characteristics of Submerged Jet Impingement Cooling using JP-5", pp. 178-183, especially title, abstract, and page 182), while, even arguendo, the experiments "to illustrate the effectiveness of gallium cooling" (pages 7-8 of original Specification) are described without reference to either submerged jet or submerged

nozzle. In conclusion, original Specification and claims do not support the amendment to claims 1, 5 and 8 and to dependent claims 2, 4, and 6-7.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. ***Claims 1, 4, 5 and 7*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Eggers (5,392,319) (previously made of record as Prior Art and cited in Specification) in view of Lidsky et al (previously made of record) and Pais et al (IEEE 0-7803-1372-0, 1994).

On claim 1: Eggers teaches (see title, abstract, and Figures 1, 10-11) a method of cooling a low Z target material of a neutron source assembly, comprising: providing flow of liquid coolant (light water and D_2O; col. 12, l. 51 – col.13, l. 68) to a low Z (col. 6, l. 13-58 and col. 7, l. 5-20) target material within the neutron assembly (target support region 116, on target carriage 26; target material is inherently part of the neutron assembly: no target material, no neutrons) (loc.cit.) to cool the low Z target material (loc.cit.).

Eggers does not necessarily teach said liquid gallium as liquid coolant. However, it would have been obvious to include the teaching of liquid gallium as coolant for an irradiation target in view of Lidsky et al (col. 7, l. 10-20) being at least suitable as equivalent to water (loc.cit.). It has been held that the selection of a particular material

known in the art to be suitable for its intended purpose would be entirely obvious. In re Leshin 125 USPQ 416. Eggers further teaches the liquid coolant 134 (col. 9, l. 28) to be provided to a non-bombarded surface (inside surface of 116 within 26 rather than the outside surface bombarded by the ion beam 22 (see Figures 1, 10).

Eggers does not necessarily teach the limitation of using "a nozzle submerged in said liquid gallium, a submerged jet of concentrated liquid gallium in a direction normal to a non-bombarded surface of the low Z target material". However, it would have been obvious to include said limitation in view of Pais et al, who, in art (inter alia on X-ray medical devices) on cooling by jet impingement (title, abstract, Introduction, page 178), hence in this regard analogous to Eggers, teach hitting the target in a direction normal to a non-bombarded surface of said low Z target material (see Figure 1 and Introduction, page 178) with a submerged jet (title, abstract) in which cooling method the nozzle is preferably completely submerged in the cooling liquid (see "Fully submerged Nozzle and Surface", page 182, and compare Figure 7 for the case of submerged nozzle with Figure 8, showing a superior heat transfer in the former case, also summarized in the conclusions (page 181-182). *Motivation* to include the teaching by Pais et al in the invention by Eggers derives from the enhanced heat transfer and consequent higher cooling efficiency, as illustrated by Figure 7 when compared with Figure 8 in Pais et al and the Conclusions by Pais et al of larger heat transfer coefficients (page 182). Parenthetically, the physics behind the superior heat transfer of submerged jets over free surface jet impingement has long been understood: see, e.g., Christiaens et al (5,795,063), especially the discussion in col. 8, l. 35-63), being due to

heat transfer by turbulence. Said turbulence arises whenever a submerged jet mixes with the surrounding liquid and hence applies also to the topography of Eggers.

Eggers does not necessarily teach the limitations on reservoir provision and specific pumping as claimed (final five lines of claim 1). However, it would have been obvious to include said limitations in view of the cooling apparatus as taught by Alger et al comprising a liquid coolant reservoir 23 (col. 2, l. 23-24) while the liquid coolant is pumped from the reservoir (through 27, see col. 2, l. 24 and Figures 1 and 2) through the nozzle 29 (col. 2, l. 57-60) such that the coolant impinges on the target (in application to Eggers low Z) target material and cools the target material (see rejection of claim 1 above), from the neutron source assembly directly to a heat exchanger 28 (col. 2, l. 24-27) to remove heat from the liquid coolant (a cooling system necessarily effects the exchange of heat and hence is a heat exchanger), means for recirculating said liquid coolant between said reservoir 23, said heat exchanger 28 and said accelerator based neutron source 11 in the form of pump 27 (thus meeting the additional limitation defined by claim 7) and nozzle 29 (col. 2, l. 24 and col. 2, l. 28-30). Note that recirculation is implied by the disclosure of a "closed loop" (see abstract). *Motivation* to include the teaching by Alger et al in the invention by Egger and Lidsky et al derives from the more efficient cooling through improved circulation as expressed by Alger et al (col. 1, l. 19-33 and 45-65) as is also generally known in the art of cooling apparatus as conventional, while circulating enables re-use, which is important for a more expensive coolant such as gallium, which expense is, however amply

compensated by the much higher coefficient of thermal conductivity (see applicant's admission in this regard on page 7 of the Specification).

On claim 4: the target material in Eggers comprises beryllium (col. 6, l. 48-51).

On claim 5: Eggers teaches a neutron source assembly 10 (title, abstract, col. 5, l. 40 – col. 6, l. 58) having a liquid cooled target (light water and D_2O; col. 12, l. 51 – col.13, l. 68), comprising: an accelerator based neutron source 16/26/116 (accelerator 16 (col. 7, l. 5-20), target carriage 26 and target 116 (col. 7, 5-20 and col. 8, l. 62-66) including a low Z target material within the accelerator-based neutron source (such as boron or beryllium) (col. 6, l. 13-59) (namely: low Z target 116 on target carriage 26; see col. 7, l. 5-20 and col. 8, l. 62-66) that is bombarded by accelerated particles (through proton accelerator 16; see col. 6, l. 13-51) to produce a neutron flux (col. 6, l. 13-59); and a cooling system (72/90 a/o, see above) to circulate liquid coolant (light water and D_2O; see above) through said accelerator based neutron source (namely: through 16/26/116) to cool the low Z target material.

Eggers does not necessarily teach said liquid gallium as liquid coolant. However, it would have been obvious to include the teaching of liquid gallium as coolant for an irradiation target in view of Lidsky et al (col. 7, l. 10-20) being at least suitable as equivalent to water (loc.cit.). It has been held that the selection of a particular material known in the art to be suitable for its intended purpose would be entirely obvious. In re Leshin 125 USPQ 416. Eggers further teaches the liquid coolant 134 (col. 9, l. 28) to be provided to a non-bombarded surface (inside surface of 116 within 26 rather than the outside surface bombarded by the ion beam 22 (see Figures 1, 10).

Eggers does not necessarily teach the limitation "said nozzle being submerged in said liquid gallium to provide a submerged jet of concentrated liquid gallium in a direction normal to a non-bombarded surface of the low Z target material".

However, whether said nozzle is submerged in liquid gallium and provides a submerged jet or not are limitations of intended use within the framework of the device invention of claim 5 (neutron source assembly being the device). Applicant is reminded that In reference to the claim language referring to "said nozzle being submerged" and "submerged jet", intended use and other types of functional language must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. In re Casey,152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963).

Furthermore, even arguendo, it would have been obvious to include said limitation in *view of Pais et al*, who, in art (inter alia on X-ray medical devices) on cooling by jet impingement (title, abstract, Introduction, page 178), hence in this regard analogous to Eggers, teach a target positioned in an assembly such that jets are capable to be directed and impinge normal to a non-bombarded surface of said low Z target material (see Figure 1 and Introduction, page 178) with a submerged jet (title, abstract) in which assembly the nozzle is preferably completely submerged in the cooling liquid (see "Fully submerged Nozzle and Surface", page 182, and compare Figure 7 for the case of

submerged nozzle with Figure 8, showing a superior heat transfer in the former case, also summarized in the conclusions (page 181-182). *Motivation* is spelled out by Pais et al to be the enhanced heat transfer, hence better cooling (see "Conclusions", page 182). Parenthetically, the physics behind the superior heat transfer of submerged jets over free surface jet impingement has long been understood: see, e.g., Christiaens et al (5,795,063), especially the discussion in col. 8, l. 35-63), recited here not for teaching but for fact only.

Eggers nor Lidsky et al nor Pais et al necessarily teach the further inclusions of the cooling system as claimed (final 7 lines of claim 5). However, it would have been obvious to include said limitations in view of the cooling apparatus as taught by Alger et al comprising a liquid coolant reservoir 23 (col. 2, l. 23-24) while the liquid coolant is pumped from the reservoir (through 27, see col. 2, l. 24 and Figures 1 and 2) through the nozzle 29 (col. 2, l. 57-60) such that the coolant impinges on the target (in application to Eggers low Z) target material and cools the target material (see rejection of claim 1 above), from the neutron source assembly directly to a heat exchanger 28 (col. 2, l. 24-27) to remove heat from the liquid coolant (a cooling system necessarily effects the exchange of heat and hence is a heat exchanger), means for serially recirculating said liquid coolant between said reservoir 23, said heat exchanger 28 and said accelerator based neutron source 11 in the form of pump 27 (thus meeting the additional limitation defined by claim 7) which satisfies "means for serially circulating" under 112, sixth paragraph (see pump 14 (Figure 1 in the Specification)) and nozzle 29 (col. 2, l. 24 and col. 2, l. 28-30). Note that recirculation is implied by the disclosure of a

"closed loop" (see abstract). *Motivation* to include the teaching by Alger et al in the invention by Egger and Lidsky et al derives from the more efficient cooling through improved circulation as expressed by Alger et al (col. 1, l. 19-33 and 45-65) as is also generally known in the art of cooling apparatus as being conventional, while circulating enables re-use, which is important for a more expensive coolant such as gallium, which expense is, however amply compensated by the much higher coefficient of thermal conductivity (see applicant's admission in this regard on page 7 of the Specification).

3. ***Claim 8*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Eggers in view of Lidsky et al, Pais et al and Alger et al.

Eggers teaches a liquid cooling system for a neutron source assembly (title, abstract, col. 5-17; Figures 1 and 10-11), said cooling system comprising: a reservoir (inherently existing behind check valve 92 of 90 as otherwise conduit 90 could not deliver said liquid coolant (col. 8, l. 24-29) (see Figures 1 and 10)); a heat exchanger 132 or 226 (col. 9, l. 23-35 and col. 13, l. 34). Eggers also teach a low Z target material (116 on 26) within the neutron source assembly 10 (col. 5, 63-68, col. 6, l. 13-58, col. 7, l. 5-20 and col. 8, l. 62-63).

Eggers does not necessarily teach said liquid gallium as liquid coolant. However, it would have been obvious to include the teaching of liquid gallium as coolant for an irradiation target in view of Lidsky et al (col. 7, l. 10-20) being at least suitable as equivalent to water (loc.cit.). It has been held that the selection of a particular material known in the art to be suitable for its intended purpose would be entirely obvious. In re

Leshin 125 USPQ 416. Eggers further teaches the liquid coolant 134 (col. 9, l. 28) to be provided to a non-bombarded surface (inside surface of 116 within 26 rather than the outside surface bombarded by the ion beam 22 (see Figures 1, 10).

Eggers does not necessarily teach the limitation "a nozzle, said nozzle being submerged in said liquid gallium providing a submerged jet of concentrated liquid gallium in a direction normal to a non-bombarded surface of the low Z target material".

However, apart from the nozzle itself, whether said nozzle is submerged in liquid gallium and provides a submerged jet or not are limitations of intended use within the framework of the device invention of claim 5 (neutron source assembly being the device). Applicant is reminded that In reference to the claim language referring to "said nozzle being submerged" and "submerged jet", intended use and other types of functional language must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. In re Casey,152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963).

Furthermore, arguendo, it would have been obvious to include said limitation in *view of Pais et al*, who, in art (inter alia on X-ray medical devices) on cooling by jet impingement (title, abstract, Introduction, page 178), hence in this regard analogous to Eggers, teach a target positioned in an assembly such that jets are capable to be directed and impinge normal to a non-bombarded surface of said low Z target material

(see Figure 1 and Introduction, page 178) with a submerged jet (title, abstract) in which assembly a nozzle is preferably completely submerged in the cooling liquid (see "Fully submerged Nozzle and Surface", page 182, and compare Figure 7 for the case of submerged nozzle with Figure 8, showing a superior heat transfer in the former case, also summarized in the conclusions (page 181-182). *Motivation* is spelled out by Pais et al to be the enhanced heat transfer, hence better cooling (see "Conclusions", page 182). Parenthetically, the physics behind the superior heat transfer of submerged jets over free surface jet impingement has long been understood: see, e.g., Christiaens et al (5,795,063), especially the discussion in col. 8, l. 35-63).

Eggers does not necessarily teach the claimed means for serially circulating. However, it would have been obvious to include said means in view of the cooling apparatus as taught by Alger et al comprising a liquid coolant reservoir 23 (col. 2, l. 23-24) while the liquid coolant is pumped from the reservoir (through 27, see col. 2, l. 24 and Figures 1 and 2) through the nozzle 29 (col. 2, l. 57-60) to the (in application to Eggers low Z) target material to cool the target material (see rejection of claim 1 above) and through a heat exchanger 28 (col. 2, l. 24-27) to remove heat from the liquid coolant (a cooling system necessarily effects the exchange of heat and hence is a heat exchanger), as well as means for serially circulating said liquid coolant between said reservoir 23, said heat exchanger 28 and said accelerator based neutron source 11 in the form of pump 27 and nozzle 29 (col. 2, l. 24 and col. 2, l. 28-30). *Motivation* to include the teaching by Alger et al in the invention by Egger and Lidsky et al derives from the more efficient cooling through improved circulation as expressed by Alger et al

(col. 1, l. 19-33 and 45-65) as is also generally known in the art of cooling apparatus as conventional, while circulating enables re-use, which is important for a more expensive coolant such as gallium, which expense is, however amply compensated by the much higher coefficient of thermal conductivity (see applicant's admission in this regard on page 7 of the Specification). In the combined invention, the liquid gallium from the reservoir through the nozzle impinges on the surface of the low Z target material within the neutron source assembly and is transferred directly to the heat exchanger, and from said heat exchanger to said reservoir by virtue of the close loop taught by Alger et al (see abstract).

Response to Arguments

Applicant's arguments filed 3/20/07 have been fully considered but they are not persuasive.

A. With regard to the Replacement Sheets for the Drawings of Figures 1 and 2 (page 6 of Remarks), yet no difference between the Replacement Sheets and the previous Drawings can be discerned. In particular, no connection between check valve and reservoir is elucidated with the replacement of Drawings with identical Drawings. Examiner notes that Applicant has not complied with the requirement under section 1 under Drawings on page 2 of the previous Office Action by providing a Drawing wherein the relation between 12 and 30 is illustrated in one and the same Figure. The objection to the Drawings is herewith repeated.

B. Similarly, the amendment to the Specification (page 6 of Remarks) does not in any way modify the relation between elements 12 and 30, 'outlet' for neutrons being

shown neither in Figure 1 nor in Figure 2. The objection to the Specification is herewith repeated.

C. With regard to the traverse of the rejections under 35 U.S.C. § 112, First Paragraph, (pages 6-7 of Remarks) examiner first notes that the claim language of all claims pending still contains the limitation "a nozzle submerged in liquid gallium" (line 3 of claim 1, line 7 of claim 5, and line 5 of claim 8), and therefore the ground for the rejection has not been removed from the claim language. Furthermore, Applicant's argument in traverse appears to be that since "the outlet 30, as illustrated in original Figure 2, from the stainless steel housing, is located above the top surface of the beryllium target 32, the reservoir 40 will fill with liquid gallium, as set forth in the originally filed specification" (page 7 of Remarks). This argument is not persuasive because

(1) Nowhere in the original specification is it disclosed that the outlet is located above the top surface of the beryllium target 32 (the direction of gravity is not indicated anywhere), while, even *arguendo*, whether the chamber 40 ('reservoir' is a misnomer anyway: 14 is the reservoir, 40 is a chamber) is completely filled depends on factors such as how much liquid gallium is injected at what speed, and how fast it is made to exit the chamber, and the specification is completely silent on these factors.

(2) The issue is rather whether the nozzle is submerged in liquid gallium in the method as claimed, which would be met for instance if the original specification would disclose *complete* filling of the *chamber* 40 (not to be confuse with the reservoir 14), which it does not. Nor is there a verbatim statement anywhere in the original

specification, on the nozzle being submerged in liquid gallium by the method as disclosed.

Therefore, the rejection under 35 U.S.C. § 112, First Paragraph, has been maintained on account of consideration (1) and (2) above.

D. With regard to the traverse of the rejections under 35 U.S.C. 103(a), (see Remarks 7-13) of claims 1 and 5:

On independent claim 1, Applicant alleges that motivation, whether with Lidsky or Pais, is flawed because Eggers' "neutron source assembly is made of aluminum" (traverse against motivation in connexion with Lidsky) while according to Applicant's second argument (page 9) the "liquid gallium of Lidsky is incompatible with the system of Pais et al because Pais et al disclose passing the coolant over a block of copper; while "liquid gallium dissolves aluminum or copper in a matter of minutes or a few hours depending on temperature". This argument does not persuade because in Eggers aluminum only is cited as an example for the material embodiment (see Eggers, col. 7, l. 31-40), while even arguendo it is merely common sense to adapt the protective foil to the liquid coolant that is selected. Furthermore, the teaching by Pais merely is on the preference of submerged jets of coolant over non-submerged jets of coolant based on a finding of enhanced heat transfer (see Conclusions). This finding is a fluid-dynamical one and as such fairly independent on material selection.

In this respect it is noted that the teaching by the non-primary reference pertains only to a particular problem to be solved, namely: efficient cooling of a target bombarded by highly accelerated particles.

Applicant is reminded in this regard that it has been held that "There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." In re Rouffet, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998). MPEP 2143.01; and that "The prior art can be modified or combined to reject claims as prima facie obvious as long as there is a reasonable expectation of success. In re Merck & Co., Inc., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)" MPEP 2143.02.

Finally, Applicant argues that "Alger fails to disclose or suggest pumping the liquid gallium, serially, from the reservoir, through the nozzle, such that the liquid gallium impinges upon the low Z target material in the neutron source assembly and cools the target material, from the neutron source assembly directly to the heat exchanger to remove heat from the liquid gallium, and from the heat exchanger to the reservoir". However, examiner did not state such, nor is the quoted teaching necessary to render the claim obvious. In the presence of the reservoir 23 (see page 11 of previous Office Action) and the closed loop (see abstract) that Alger et al do teach, Alger et al amply supplement the references. The serial pumping as claimed is not in contradiction with an additional avenue 28 for the coolant in the reservoir.

In summary, Applicant's arguments fail to persuade, and the newly amended claim 1 is unpatentable over the same combination of prior art as cited in the previous office action.

On independent claim 5, Applicant alleges that motivation, whether with Lidsky or Pais, is flawed because Eggers' "neutron source assembly is made of aluminum" (traverse against motivation in connexion with Lidsky) while according to Applicant's second argument (page 9) the "liquid gallium of Lidsky is incompatible with the system of Pais et al because Pais et al disclose passing the coolant over a block of copper; while "liquid gallium dissolves aluminum or copper in a matter of minutes or a few hours depending on temperature". This argument does not persuade because in Eggers aluminum only is cited as an example for the material embodiment (see Eggers, col. 7, l. 31-40), while even arguendo it is merely common sense to adapt the protective foil to the liquid coolant that is selected. Furthermore, the teaching by Pais merely is on the preference of submerged jets of coolant over non-submerged jets of coolant based on a finding of enhanced heat transfer (see Conclusions). This finding is a fluid-dynamical one and as such fairly independent on material selection.

In this respect it is noted that the teaching by the non-primary reference pertains only to a particular problem to be solved, namely: efficient cooling of a target bombarded by highly accelerated particles.

Applicant is reminded in this regard that it has been held that "There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." In re Rouffet, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998). MPEP 2143.01; and that "The prior art can be modified or combined to reject claims as prima facie obvious as long as there is a reasonable expectation of success.

In re Merck & Co., Inc., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)" MPEP 2143.02.

Finally, Applicant argues that "Alger fails to disclose or suggest pumping the liquid gallium, serially, from the reservoir, through the nozzle, such that the liquid gallium impinges upon the low Z target material in the neutron source assembly and cools the target material, from the neutron source assembly directly to the heat exchanger to remove heat from the liquid gallium, and from the heat exchanger to the reservoir". However, examiner did not state such, nor is the quoted teaching necessary to render the claim obvious. In the presence of the reservoir 23 (see page 11 of previous Office Action) and the closed loop (see abstract) that Alger et al do teach, Alger et al amply supplement the references. The serial pumping as claimed is not in contradiction with an additional avenue 28 for the coolant in the reservoir.

In summary, Applicant's arguments fail to persuade, and the newly amended claim 5 is unpatentable over the same combination of prior art as cited in the previous office action.

E. With regard to the traverse of the rejection under 35 U.S.C. 103(a) of claim 8 (Remarks 13-6).

Applicant alleges that motivation, whether with Lidsky or Pais, is flawed because Eggers' "neutron source assembly is made of aluminum" (traverse against motivation in connexion with Lidsky) while according to Applicant's second argument (page 9) the "liquid gallium of Lidsky is incompatible with the system of Pais et al because Pais et al disclose passing the coolant over a block of copper; while "liquid gallium dissolves

aluminum or copper in a matter of minutes or a few hours depending on temperature". This argument does not persuade because in Eggers aluminum only is cited as an example for the material embodiment (see Eggers, col. 7, l. 31-40), while even arguendo it is merely common sense to adapt the protective foil to the liquid coolant that is selected. Furthermore, the teaching by Pais merely is on the preference of submerged jets of coolant over non-submerged jets of coolant based on a finding of enhanced heat transfer (see Conclusions). This finding is a fluid-dynamical one and as such fairly independent on material selection.

In this respect it is noted that the teaching by the non-primary reference pertains only to a particular problem to be solved, namely: efficient cooling of a target bombarded by highly accelerated particles.

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Finally, Applicant argues that "Alger fails to disclose or suggest pumping the liquid gallium, serially, from the reservoir, through the nozzle, such that the liquid gallium impinges upon the low Z target material in the neutron source assembly and cools the

target material, from the neutron source assembly directly to the heat exchanger to remove heat from the liquid gallium, and from the heat exchanger to the reservoir". However, examiner did not state such, nor is the quoted teaching necessary to render the claim obvious. In the presence of the reservoir 23 (see page 11 of previous Office Action) and the closed loop (see abstract) that Alger et al do teach, Alger et al amply supplement the references. The serial pumping as claimed is not in contradiction with an additional avenue 28 for the coolant in the reservoir.

In summary, Applicant's arguments fail to persuade, and the newly amended claim 5 is unpatentable over the same combination of prior art as cited in the previous office action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JPM
May 27, 2007

Primary Patent Examiner:
Johannes Mondt (TC 3600, Art Unit: 3663)